

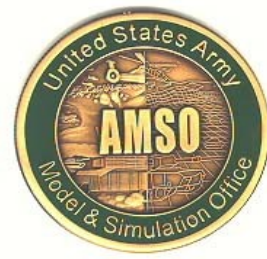
# **Army Modeling and Simulation Policy and Guidance**

**Army-Navy VV&A TWG Meeting  
14-15 November 2001**

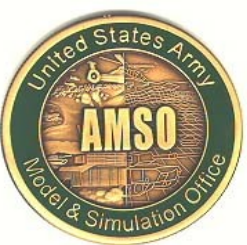
**Debra C. Ridgeway  
Army Model & Simulation Office**

# Agenda

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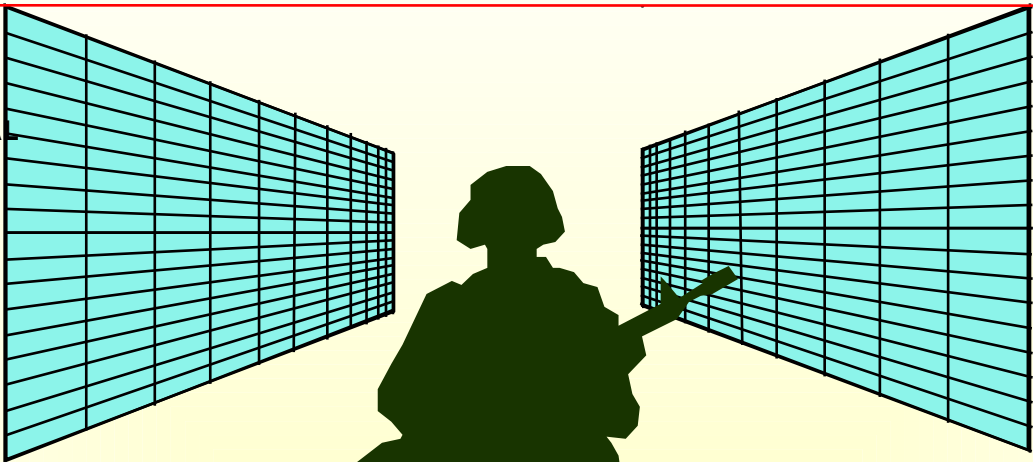


- **Why is M&S important?**
- **Who is AMSO?**
- **What is the Army M&S strategy?**
- **What are the Army M&S policies and guidance?**
- **What are some key points in AR 5-11?**
- **What are some key points in DA Pam 5-11?**
- **What is SMART?**



# CHANGING MILITARY ENVIRONMENT

- ☐ EXPANDING MULTI-DIMENSIONAL BATTLESPACE
- ☐ AMBIGUITY AND COMPLEXITY OF MISSIONS
- ☐ LESS TIME TO PREPARE, LESS NOTICE TO DEPLOY
- ☐ FASTER TEMPO OF OPERATIONS

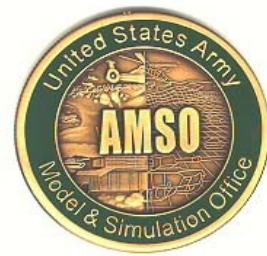


- ☐ MYRIAD OF WEAPONRY
- ☐ CRITICAL DECISIONS AT LOWER LEVELS
- ☐ LIMITED EXPERIENCE BASE
- ☐ "MAKING IT UP AS WE GO"



# U. S. Army Modeling & Simulation Bottom Line Up Front

---



## ➤ **ARMY IS INCREASINGLY RELIANT ON M&S**

- Increasing importance to training
- Increasing importance for concept exploration
- Increasing importance in materiel development programs

## ➤ **However: State-of-the-Art limits being pushed**

- Inadequate modeling for emerging major mission areas and for high definition system modeling
- OJT trained workforce
- M&S systems still cost too much
- Interoperability still a mystery

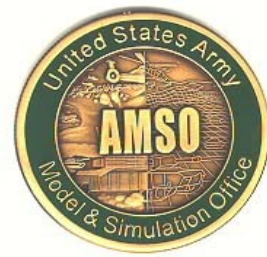
■ Cross-Domain Integration Necessitates a Cultural Change





# AMSO Charter

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## Purpose for AMSO:

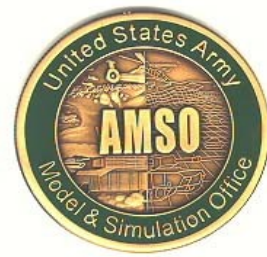
**The CSA (**GEN Reimer**) identified a lack of strategic-level focus and synchronization for the Army's efforts in models and simulations.**

**MG Eric K. Shinseki, ADCSOPS, directed AMSO to:**

- **Specifically, monitor/influence activities across all domains to preclude duplication of effort and wasted resources.**
- **Prioritize major M&S thrusts across the domains, and to derive a sound investment strategy to achieve the coordinated needs of the synthetic battlefield.**

# Army Model and Simulation Office

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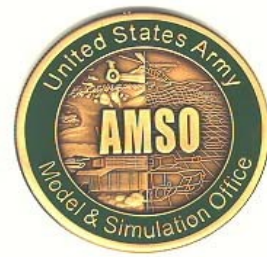
## Mission Statement

In support of the Army - its mission and soldiers - the Army Model and Simulation Office (AMSO) provides the **vision, strategy, oversight, and management** of Models and Simulations (M&S) across all M&S domains.

## Core Competencies

- **Develop and promulgate the Army's ;**
- Ensures the **integration of M&S** across Army M&S domains
- Assist senior leaders in properly **resourcing** Army M&S programs;
- **Foster reuse** and development of common M&S components and t
- Act as **focal point for Army M&S matters** with the Joint Staff, CINCPAC, DARPA, DMSO, Services, DoD Agencies and OSD staff elements;
- **Promote** the Army's **M&S research** program.
- Executive agent for Simulation & Modeling for Acquisition, Requirement and Training (**SMART**)
- Establish and Execute **Functional Area 57** Proponency

# Army M&S Management



Army Model and Simulation  
General Officer Steering Committee

Army Model and Simulation  
Executive Committee (AMSEC)

DCSOPS

Military Deputy  
Assistant Secretary for  
Acquisition

DUSA(OR)

DCSPRO

Army Model and Simulation Office  
(AMSO)

Domain Manager  
Executive Management  
Board

Model and Simulation Domain

Training, Exercise and  
Military Operations  
(TEMO)

Advanced Concepts &  
Requirements (ACR)

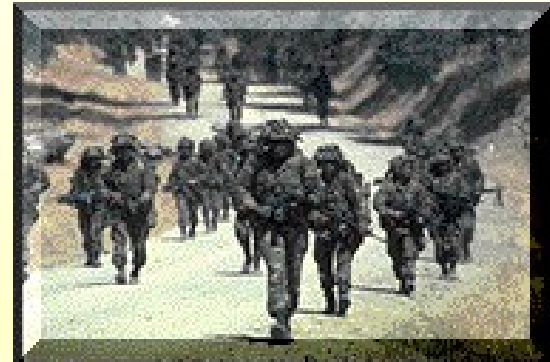
Research, Development  
and Acquisition (RDA)

# HQDA Modeling & Simulation Management



**SECRETARIAT**

Deputy Under  
Secretary  
of the Army (OR)  
Mr. Walt Hollis

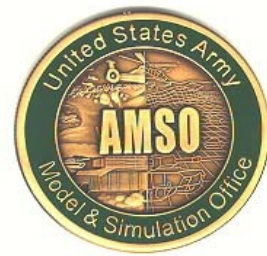


**ARMY STAFF**

Deputy  
Chief of Staff  
for  
Operations & Plans  
LTG David McKiernan

**Army Model & Simulation Office**





# Army M&S Domain Structure

## Advanced Concepts & Requirements

### Activities

- Force Design
- Force Development
- Operational Requirements
- Warfighting Experiments

### Simulations / Simulators

- Reconfigurable Simulators
- Constructive Models

## Training, Exercises, & Military Operations

### Activities

- Individual & Collective Training
- Joint / Combined Exercises
- Mission Rehearsal
- Operational Planning

### Simulations / Simulators

- System Simulators
- Training Simulations

## Research, Development & Acquisition

### Activities

- Basic/Applied Research
- Weapon System Development
- Materiel Acquisition
- Test and Evaluation

### Simulations / Simulators

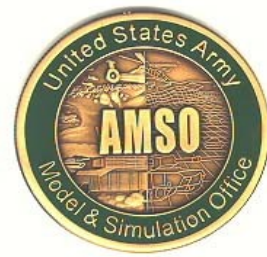
- System Prototypes,
- Engineering / Physical Models

AMSO



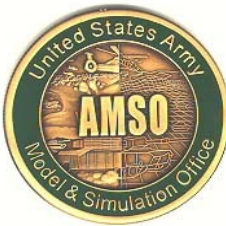
# Army M&S Policy...

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...shall be responsive to the dynamic M&S environment and will develop and maintain required M&S guidance, ensuring that it is integrated and synchronized into appropriate Army directives and publications. Further, shall ensure Service M&S guidance requirements are coordinated in the development of DoD and Joint directives and publications.

# U. S. Army M&S Strategic Direction



## Integrating the Community

- Fully Integrated Across ACR, RDA and TEMO Domains
- Fully Integrated with External Army M&S Activates

## Advancing the Capability

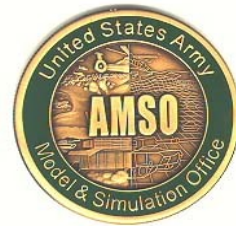
- Concept to Full Mission Ready Without Leaving The Computer
- Full Integrated Live-Virtual-Constructive Operating Environment

## Institutionalizing the Process

- Providing Vision, **Policy**, Resources, and Standard Products
- Providing for a Skilled Workforce

# Institutionalizing the Process

---



## ➤ People

- **Professional Certification for M&S Professionals**
- **University Undergraduate/Graduate M&S Programs**
- **DoD Training**
- **U.S. Military Academy M&S Chair**

## ➤ Processes

- **Standard Practices Manual**
- **Standard Algorithms**
- **Integrating the DoD and commercial business practices**

# Army M&S Guidance

**AR 5-11**

**MANAGEMENT OF ARMY MODELS AND SIMULATION**

**DA PAM 5-11**

Management

**Verification**

**Validation, and Accreditation of Army Models and Simulations**

**Policy**

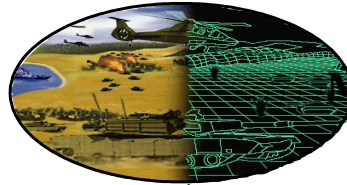
**The Army Model and Simulation Master Plan**



**U. S. Army Modeling & Simulation Science & Technology Master Plan**



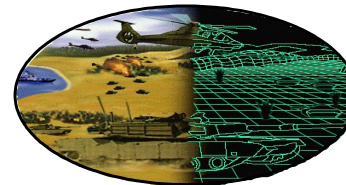
**U. S. Army Modeling & Simulation**



**Investment Plan**

**Practice**

**U. S. Army Modeling & Simulation**



**Domain Management Plans**

**Management**



**PLANNING GUIDELINES FOR SIMULATIONS AND MODELS FOR ACQUISITION, REQUIREMENTS AND TRAINING**

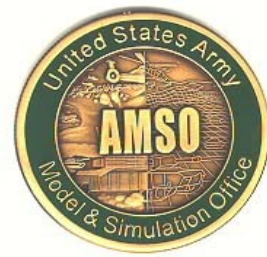
**Army's SSP**

**Program Management**

- **SMART Execution Plan**
- **High Level Architecture (HLA)**
- **Transformation M&S Best Practices**
- **Standard Algorithm**



# M&S Guidance Documents



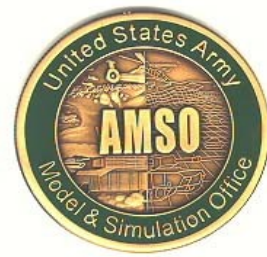
## DoD

2000 Oct	DoDD 5000.1	Defense Acquisition
1995 Oct	DoDD 5000.59-P	Modeling and Simulations Master Plan
2001 Jan	DoD 5000.2-R	MDEPS & MAIS Acquisition Programs
Being Staffed	DoDI 5000.61	DoD M&S VV&A
2000 May	DoD	DMSO - VV&A Recommended Practices Guide

## ARMY

1997 July	AR 5-11	Management of Army Models and Simulations
1999 Sep	DA Pam 5-11	VV&A of Army Models and Simulations
1997 Oct		Army M&S Master Plan
1998 Oct		Army M&S Standards Report FY 99
2000 April		Guidelines: Use of M&S to Support T&E
2000 Nov		SMART Execution Plan
2000 Sep		Planning Guideline for SMART

# Army Regulation 5-11



## AR 5-11

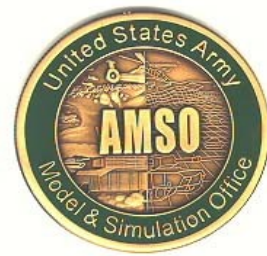
### MANAGEMENT OF ARMY MODELS AND SIMULATIONS

Headquarters  
Department of the Army  
Washington, DC  
10 July 1997  
UNCLASSIFIED

## AR 5-11, Management of Army Models Simulations

**In General:** This document is the Army's regulatory guidance governing the development, acquisition and use of models and simulations (M&S). Responsibilities of Headquarter Department of the Army (HQ DA) Staff are outlined, as well as the execution of M&S management through domain managers and agents. Establishes the roles of the Army Model and Simulation Office (AMSO), Army Model and Simulation General Officer Steering Committee (AMS GOSC) and the Army Model and Simulation Executive Council (AMSEC). Provides guidance for the Army M&S Management Program, Configuration Management, Data Management, M&S Release, Verification, Validation and Accreditation (VV&A), and M&S Life Cycle Management.

# AR 5-11, Table of Contents



Army Regulation 5-11

Management

## **Management of Army Models and Simulations**

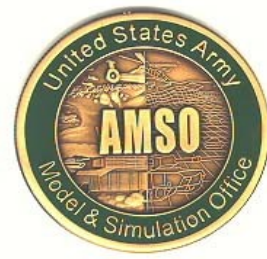
Headquarters  
Department of the Army  
Washington, DC  
10 July 1997

**UNCLASSIFIED**

### TABLE OF CONTENTS

Chapter 1 - Introduction  
Chapter 2 - Concept and  
Execution M&S  
Management in the Army  
Chapter 3 - General Policy  
Guidance  
Chapter 4 - Army Model  
and Simulation  
Management Program  
Chapter 5 - Verification,  
Validation, and  
Accreditation  
Chapter 6 - Configuration  
Management  
Chapter 7 - Data  
Management  
Chapter 8 - Model and

# AR 5-11: Some Key Points on VV



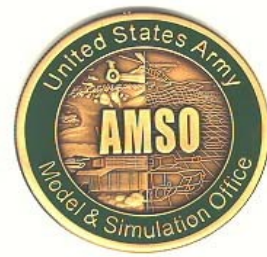
## AR 5-11

### MANAGEMENT OF ARMY MODELS AND SIMULATIONS

Headquarters  
Department of the Army  
Washington, DC  
10 July 1997  
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- Army established VV&A policy in 1996
- Supports DoDD 5000.59 and DoDI 5000.61
- AMSO is the Army's focal point for VV&A
- Accreditation of an Army model is subject to the approval of the AMSEC
- VV&A will be accomplished in concert with and as part of , the overall configuration management of each M&S
- VV&A activities shall include a simulation support plan
- VV&A plans and reports shall be completed according to the details in DA PAM 5-11

# Department of Army Pamphlet 5-



## DA PAM 5-

11

Management

**Verification,  
Validation,  
and  
Accreditation of Army  
Models and  
Simulations**

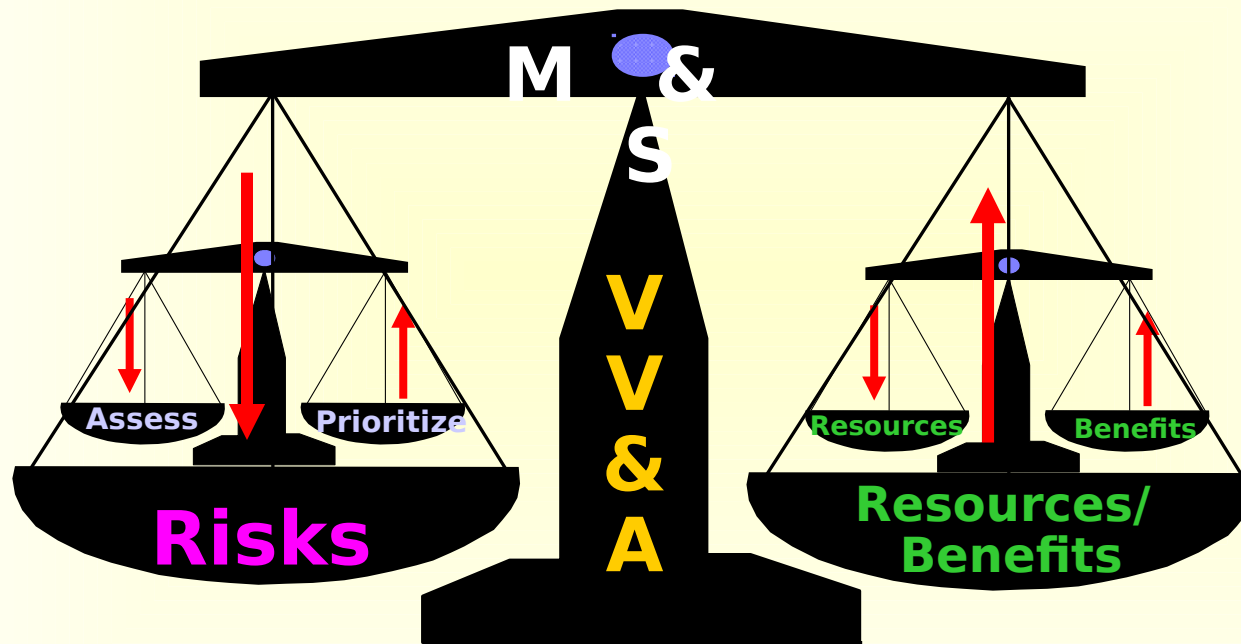
## **DA PAM 5-11, Verification, Validation and Accreditation of Army Models and Simulations.**

**In General:** This pamphlet gives procedures for the "Management of Army Models and Simulations" (AR 5-11). The objective of this pamphlet is to assist the models and simulations (M&S) developer, proponent, and application sponsor in conforming to the verification, validation, and accreditation (VV&A) policies prescribed in AR 5-11. This pamphlet provides guidance for the development, execution, and reporting of all VV&A activities. This pamphlet also addresses data V&V and accreditation in reference to proper M&S use.

**Date of last published document:** 30  
September 1999



# What is all the fuss about?



**“Establishing M&S Credibility”**

Policies & Information About M&S  
Guidance  
M&S Uses, Requirements

**VV&A is not  
a rubber stamp**

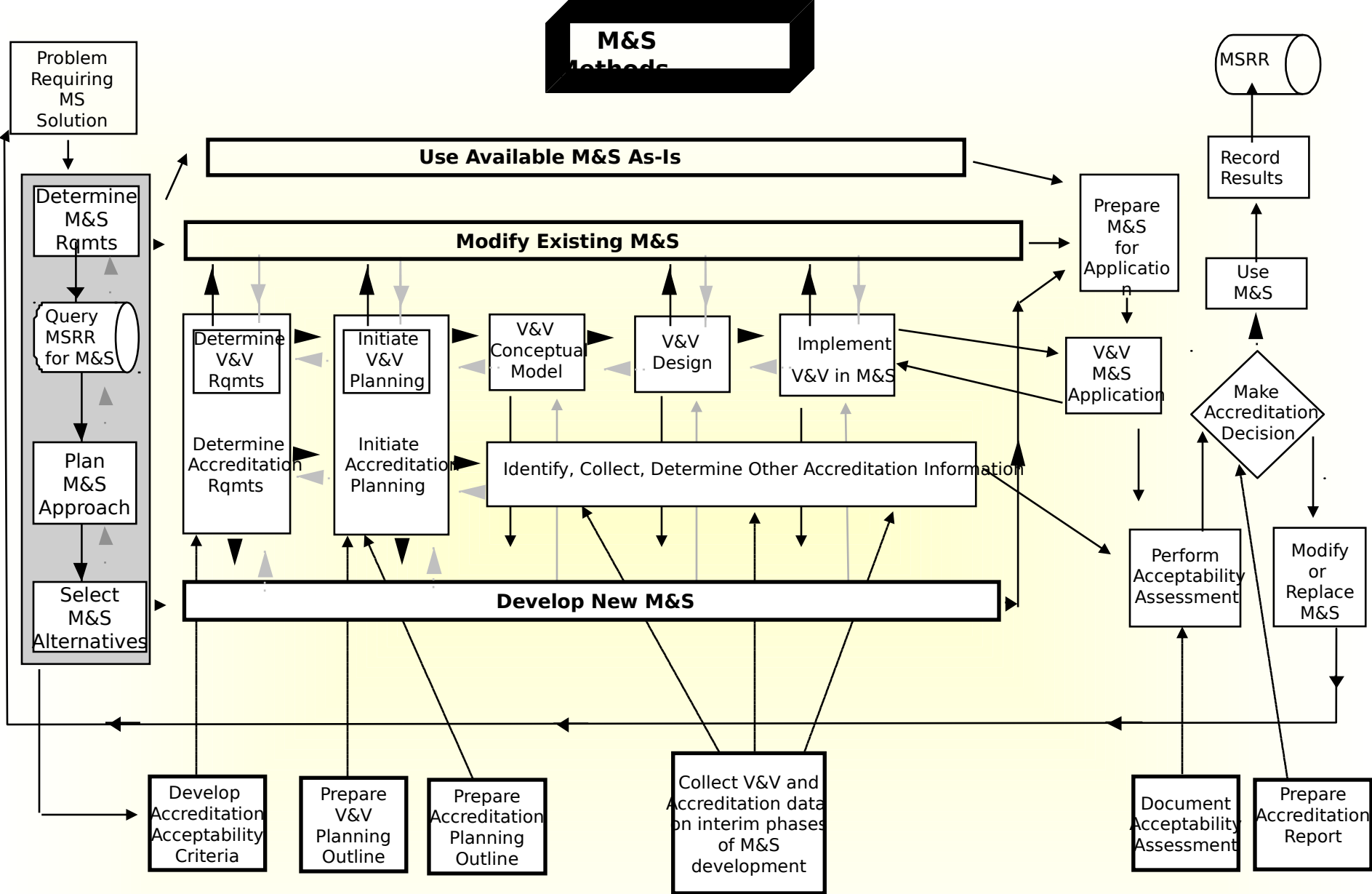


**Nor is VV&A a  
check on a list**



**VV&A IS an  
iterative  
process**





**Figure 2-2. Typical Army M&S Life-Cycle Incorporating VV&A. (From DA PAM 5-11,**

# Building Using

## VV&A

Confidence

Credibility

Interoperability

Model and  
Simulation

and its Data  
Accreditation

M&S acceptable?

M&S acceptable?

Criteria Comparison

V  
E  
R  
I  
F  
I  
C  
A  
T  
I  
O  
N

V  
E  
R  
I  
F  
I  
C  
A  
T  
I  
O  
N

Is the M&S realistic?

Does the M&S  
work  
as intended?

V  
A  
L  
I  
D  
A  
T  
I  
O  
N

V  
A  
L  
I  
D  
A  
T  
I  
O  
N

Independent

Independent

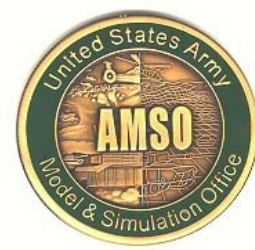
Data Sources

Acceptability

Intended Uses

Identify Key Aspec

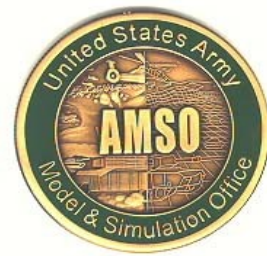
# Checklist for VV&A of M&S



Step	Life Cycle Management of M&S	VV&A Action	VV&A Results
<b>1</b>	<ul style="list-style-type: none"> <li>- Define problem</li> <li>- Determine requirements</li> <li>- Query MSRR for M&amp;S <b>and</b></li> <li>- Determine approach</li> </ul>	<ul style="list-style-type: none"> <li>- Develop Accreditation Acceptability Criteria</li> </ul>	<ul style="list-style-type: none"> <li>- Accreditation Acceptability Criteria Document</li> </ul>
<b>2</b>	- Use M&S meeting requirements		
<b>2.a</b>	- Use Available M&S "As-Is"		
<b>2.b</b>	<ul style="list-style-type: none"> <li>- Modify Existing M&amp;S <b>or</b></li> <li>- Develop New M&amp;S</li> </ul>		
<b>2.b.1</b>	<ul style="list-style-type: none"> <li>- Determine modification requirements <b>or</b></li> <li>- Determine M&amp;S requirements</li> </ul>	<ul style="list-style-type: none"> <li>- Determine V&amp;V requirements</li> <li>- Determine Accreditation requirements</li> </ul>	
<b>2.b.2</b>	<ul style="list-style-type: none"> <li>- Plan modifications <b>or</b></li> <li>- Plan M&amp;S development</li> </ul>	<ul style="list-style-type: none"> <li>- Initiate V&amp;V planning</li> <li>- Prepare V&amp;V planning outline</li> <li>- Initiate Accreditation planning</li> <li>- Prepare Accreditation planning outline</li> </ul>	<ul style="list-style-type: none"> <li>- V&amp;V Plan</li> <li>- Accreditation Plan</li> </ul>
<b>2.b.3</b>	<ul style="list-style-type: none"> <li>- Modify conceptual model (<i>if it exists</i>) <b>or</b></li> <li>- Develop conceptual model</li> </ul>	<ul style="list-style-type: none"> <li>- V&amp;V conceptual model</li> <li>- Identify, collect and determine other Accreditation information</li> <li>- Collect V&amp;V and Accreditation data on interim phases of M&amp;S development</li> </ul>	
<b>2.b.4</b>	<ul style="list-style-type: none"> <li>- Develop and Test M&amp;S modifications design <b>or</b></li> <li>- Develop and Test M&amp;S design</li> </ul>	<ul style="list-style-type: none"> <li>- V&amp;V test design</li> <li>- Identify, collect and determine other Accreditation information</li> <li>- Collect V&amp;V and Accreditation data on interim phases of M&amp;S development</li> </ul>	
<b>2.b.5</b>	<ul style="list-style-type: none"> <li>- Implement and Test M&amp;S modifications <b>or</b></li> <li>- Implement and Test New M&amp;S <b>and</b></li> <li>- Post development Software Support</li> </ul>	<ul style="list-style-type: none"> <li>- Implement V&amp;V in M&amp;S</li> <li>- Identify, collect and determine other Accreditation information</li> <li>- Collect V&amp;V and Accreditation data on interim phases of M&amp;S development</li> </ul>	<ul style="list-style-type: none"> <li>- V&amp;V Report</li> </ul>
<b>3</b>	Prepare M&S for application	<ul style="list-style-type: none"> <li>- V&amp;V M&amp;S Application</li> <li>- Perform Acceptability Assessment</li> <li>- Document Acceptability Assessment findings</li> </ul>	
<b>4</b>	Execute M&S	<ul style="list-style-type: none"> <li>- Make accreditation decision</li> </ul>	<ul style="list-style-type: none"> <li>- Accreditation Report</li> </ul>
<b>5</b>	Integrate Results		
<b>6</b>	Present and record results		
<b>7</b>	Document results in MSRR		



# DA Pam 5-11, VV&A M&S T&E Bottom



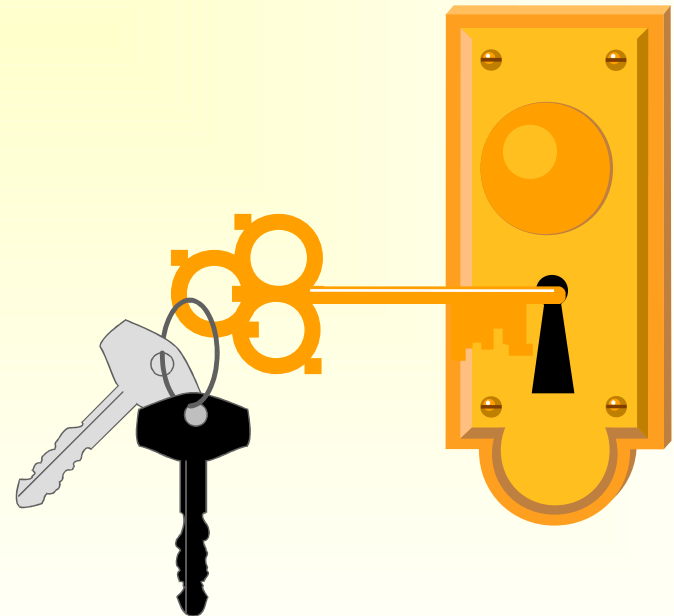
## DA PAM 5-11 Management Verification, Validation, and Accreditation of Army Models and Simulations

- VV&A is a value added function
  - “risk reduction” tool
  - provides an audit trail
- VV&A begins when M&S concept development begins
- Brings all the stakeholders together
  - communication from cradle to grave
  - helps to identify all input and output requirements and products

**M&S involved with T&E must be ACCRE**

**This means a**

# Keys to Conduct A Successful M&S VV&A



# Keys To Conduct A Successful M&S VV&A

**1** VV&A should be involved at the beginning of the M&S planning and preparation stage.

- Easier to capture data while going through the process

**2** Sets precedent for configuration management and what data should be captured, how it should be and evaluated

**3** Realize some verification and validation activities

**3** are conducted on M&S, though not captured.

- Information may or may not exist as expected
- Need to identify where, then go back and capture it

**4** Know how to accredit, which means understand the process

# Keys To Conduct A Successful M&S VV&A

4

**Understand the problem clearly.**

essential

- Determine accreditation requirements -
- Conduct impact and risk assessments
- Think about what needs to be represented
- Think about how it should be represented

5

**Derive M&S requirements.**

tasks

- Priorities help identify most critical V&V
- Basis for model selection and accreditation
- Keep a record or log of the uses

6

**Tailor accreditation requirements.**

- Foundation for V&V planning
- Tailor by risk assessment
- Tailor by what is already known

# **Sample Documentation Outlines**

# **Sample Accreditation Plan Format**

- a. Background**
- b. Accreditation responsibilities**
- c. Schedules, milestones, and resources**
- d. Intended uses of the M&S**
- e. Information sources**
- f. Acceptability criteria**
- g. Proposed accreditation methodology**

**Source: DA RAM 5-11, Appendix H, dated Sept 1999**



# Sample Acceptability

## Criteria

- The levels of force structure and interaction have sufficient fidelity and resolution.
- The M&S is suitable for the overall intended use (e.g., training, explanatory, predictive).
- The M&S output/results may be used clearly, adequately and appropriately to address the problem.
- The CM policy is in effect and responsive to the anticipated needs of the M&S users.
- All required data values are well defined and data sources for obtaining accredited data have been identified.
- The M&S runs may be accomplished and results analyzed within the project timelines. Excessive run time, however, does not discredit the appropriateness of the M&S for the problem or class of problems being addressed. (*NOTE: This acceptability criterion should not use terms such as "fast", etc. Terms should be explicit in nature, e.g., "overnight", etc.*)
- There is availability of baseline scenarios, terrain data, threat data, and weapon performance data for the M&S.
- The algorithms, terrain and environment representations are functionally adequate to address the issues.
- The clarity, fidelity, complexity and level of detail of the simulated entities are acceptable for its intended usage.
- The documentation, user training, and user help are adequate.

**Source: DA PAM 5-11, Appendix H, dated Sept 1999**

# **Sample Format for a V&V Plan**

- a. Purpose.**
- b. Background.**
  - 1-General M&S description.**
  - 2-Configuration management procedures.**
  - 3-Identification of agencies.**
- c. V&V responsibilities.**
- d. Intended uses of the M&S.**
- e. Information sources.**
  - 1-M&S documentation.**
  - 2-M&S developers.**
  - 3-SMEs.**
  - 4-Identification of comparison data.**
  - 5-Previous V&V.**
- f. Verification plan**
  - 1-Methodology design.**
  - 2-Tasks and milestones.**
  - 3-Report procedures and deliverables.**
- g. Validation plan.**
  - 1-Methodology design.**
  - 2-Evaluation criteria.**
  - 3-Tasks and milestones.**
  - 4-Report procedures and deliverables.**
- h. Required resources tied to V&V methodologies.**
- i. Appendices**

**Source: DA PAM 5-11, Appendix F, dated Sept 1999**

# **Sample Format for a V&V Report**

- a. Executive summary of the V&V results**
- b. Overview of the V&V plan**
- c. Description of the verification process and/or tests**
  - 1. Logic verification**
  - 2. Code verification**
  - 3. Unresolved issues**
- d. Description of the validation process and/or tests**
  - 1. Evaluation criteria**
  - 2. Structural validation**
  - 3. Output validation**
  - 4. Unresolved issues**
- e. Identified assumptions, constraints and limitations**
- f. Planned & accomplished V&V activities**
- g. References/attachments**
- h. Appendices.**

**Source: DA PAM 5-11, Appendix G, dated Sept 1999**

# **Sample Accreditation Report Form**

**a. Executive summary**

**b. Accreditation Assessment**

**1) Accreditation results and recommendations**

**2) List accreditation limitations for class**

**c. Acceptability criteria**

**List the criteria used for the basis of the accreditation decision.**

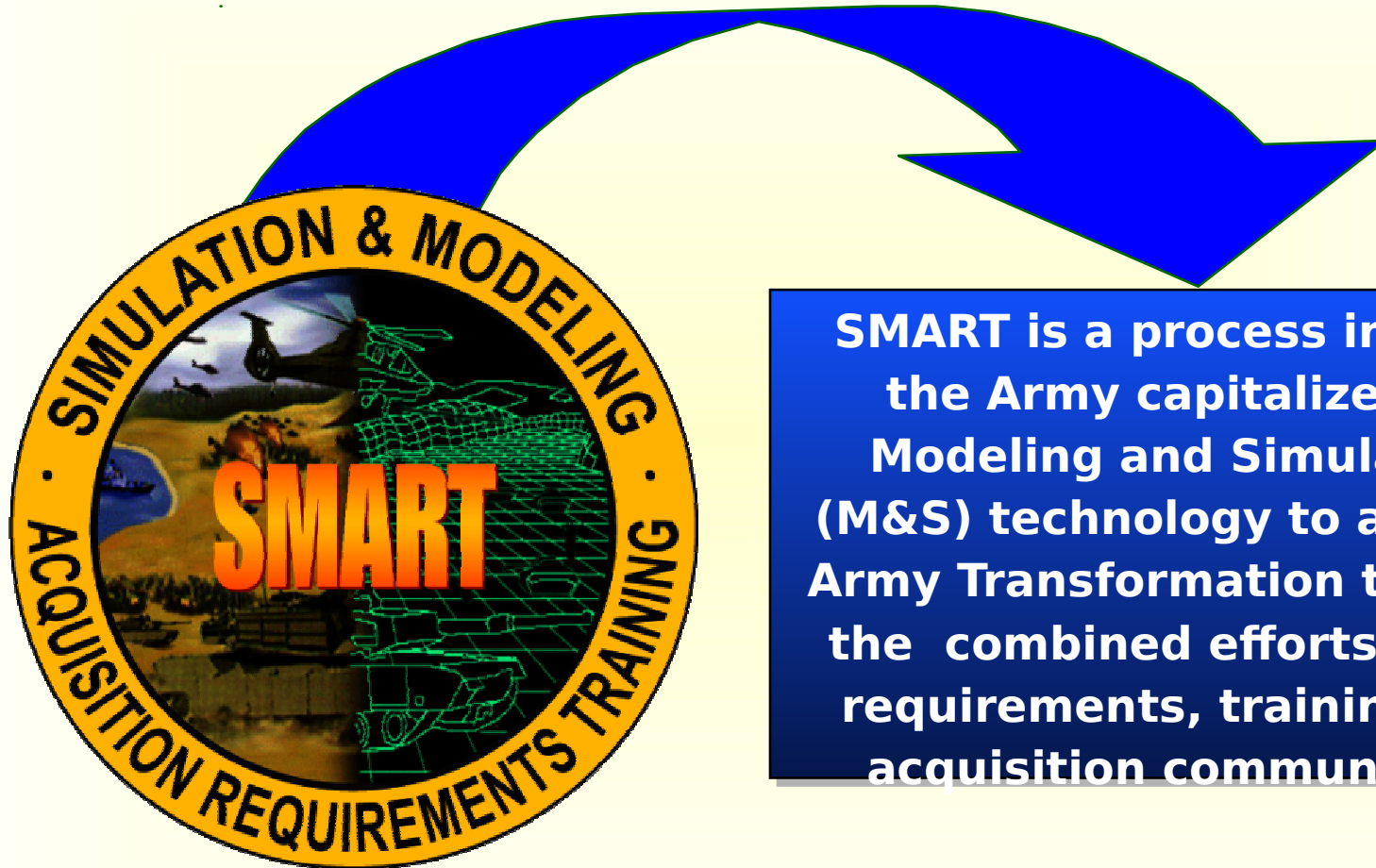
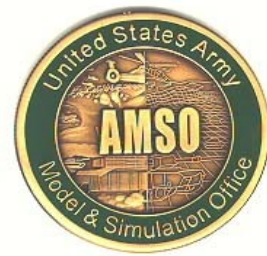
# Army V&V and Accreditation Responsibilities

	M&S Sponsor	M&S Developer	Accreditation Action Officer
V&V Plan	Responsible	Assists	Aware / Assists
Verification	Responsible	Performs	Use
Validation	Responsible	Assists	Use / Assists
V&V Documentation	Responsible	Assists	Awareness
Accreditation Plan	Assists	Assists	Responsible
Accreditation	Assists	Assists	Responsible
Accreditation Request	Assists	Assists	Responsible

For a description of the VV&A responsibilities by role  
Go to Table 2-1 in DA PAM 5-11 dated September 1999.

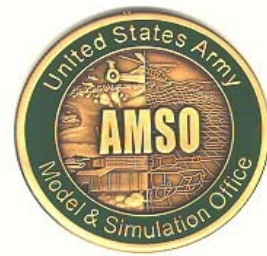
# SMART Initiative

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**SMART is a process in which the Army capitalizes on Modeling and Simulation (M&S) technology to address Army Transformation through the combined efforts of the requirements, training and acquisition communities.**

**Purpose is to build an information age infrastructure  
to enable Army Transformation.**



# Impact of SMART on Army

---

**Goal:** Formalize the role of M&S in the requirement, acquisition and training processes.

**How:** Define system relationship from cradle to grave through M&S

- emphasizing integration and interoperability
- establish and show M&S link and correlation

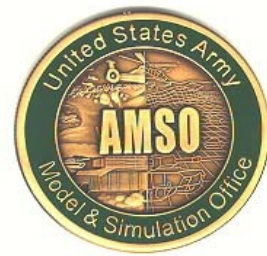
**Policy** →

**Process** →

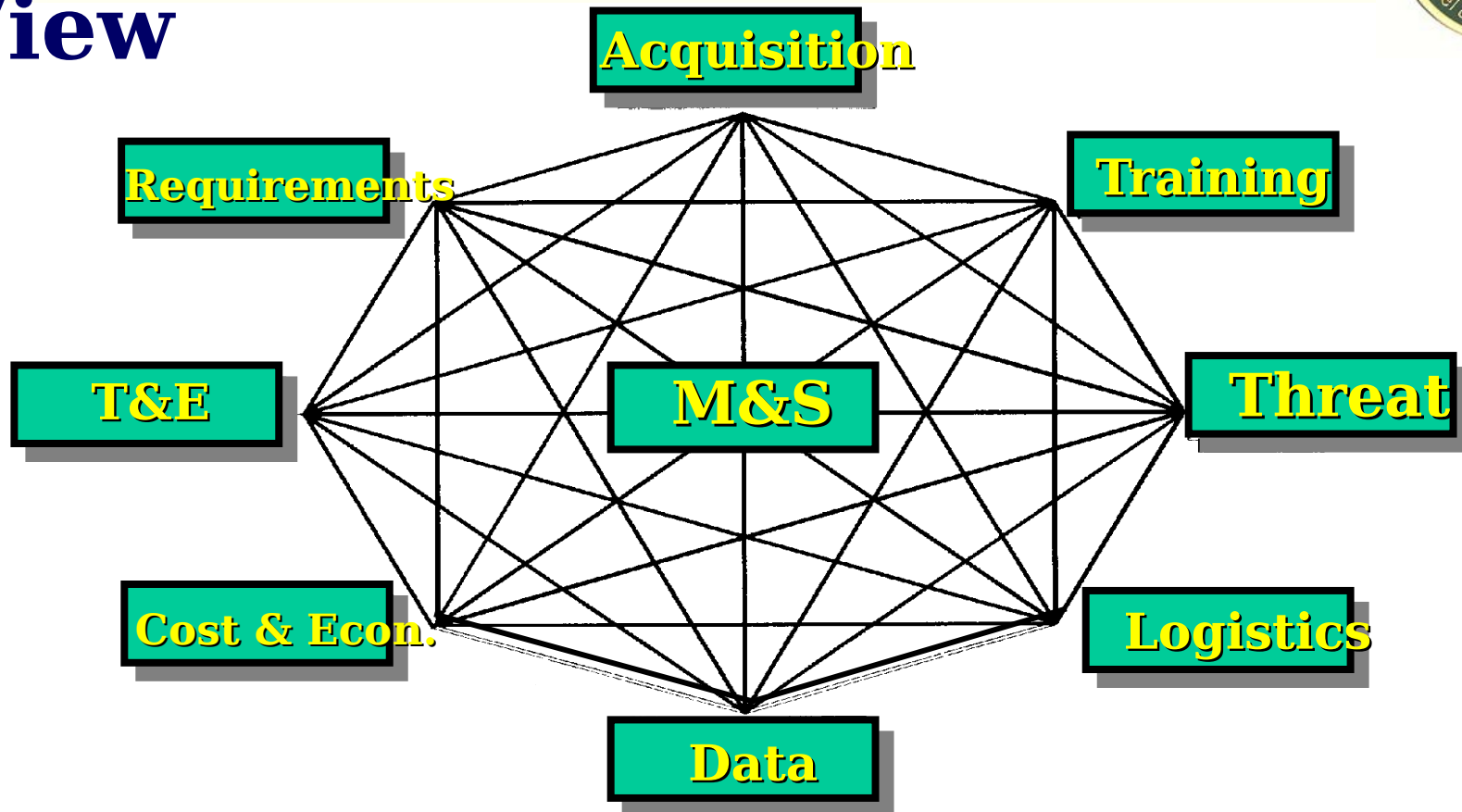
**Culture**





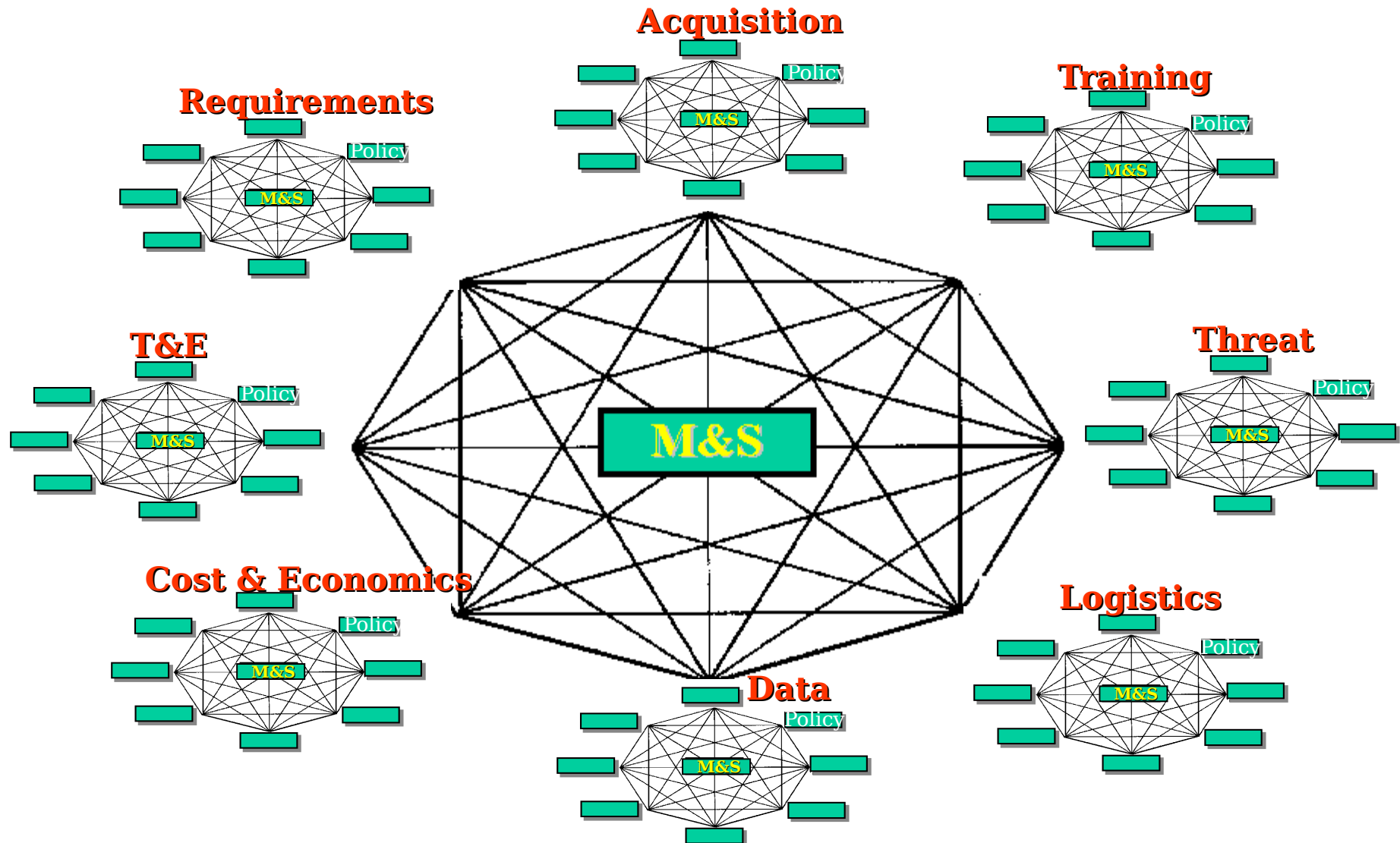
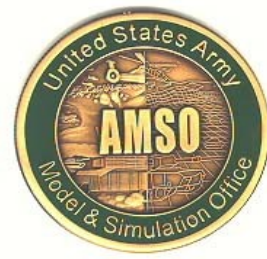


# Sample SMART Global View



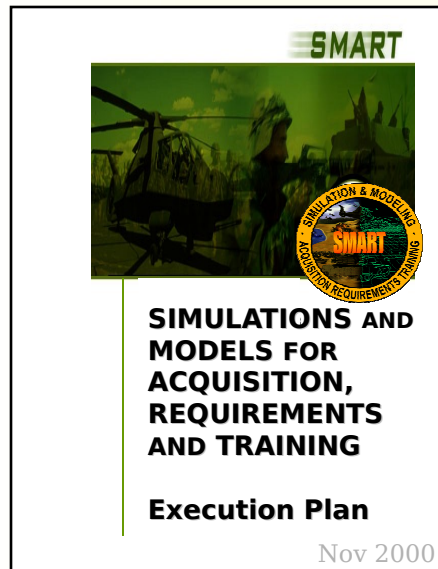
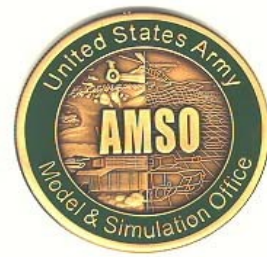
**More nodes could be included in this network, such as military operations, personnel, contracts, C4I, RD&E, etc., it just depends on the needs of the infrastructure built.**

# Expanded SMART Global View of Sample



# SMART Execution Plan

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- Objective 1-1:  
“... modify policies to effectively leverage M&S and synchronize efforts of the requirements, training and operations, acquisition, and fielding communities to reduce duplication of effort.”
- 10 policy tasks associated with this objective.

# SMART Conference - Building A Culture



1

M&S Life Cycle  
Training & Rehears

M&S Life Cycle  
Operational Analysis

M&S Life Cycle  
(Cost)

Partnership  
(NASA)

Education  
(USMA)

16-19 April 2001

Orlando, FL



2

M&S Life Cycle  
M&S Life Cycle  
Test & Evaluation

M&S Life Cycle  
M&S Life Cycle  
(Logistics)

M&S Life Cycle  
M&S Life Cycle  
Technical Engineeri

Partnership  
Partnership  
(DOT)

Education  
Education  
(DSMC)

April 2002 Salt Lake City, UT



3

M&S Life Cycle  
M&S Life Cycle  
M&S Life Cycle  
(Deployability)

M&S Life Cycle  
M&S Life Cycle  
M&S Life Cycle  
Personnel Assessme

M&S Life Cycle  
M&S Life Cycle  
M&S Life Cycle  
(Risk)

Partnership  
Partnership  
Partnership  
(Industry)

Education  
Education  
Education  
(ALMC)

April 2003 San Antonio, TX (Tentative)



4

M&S Life Cycle  
M&S Life Cycle  
M&S Life Cycle  
Training & Rehears

M&S Life Cycle  
M&S Life Cycle  
M&S Life Cycle  
Operational Analysis

M&S Life Cycle  
M&S Life Cycle  
M&S Life Cycle  
Test & Evaluation

Partnership  
Partnership  
Partnership  
(DOE)

Education  
Education  
Education  
Education  
(War College)

April 2004 New Orleans, LA

(Tentative)



5

M&S Life Cycle  
M&S Life Cycle  
M&S Life Cycle  
(Logistics)

M&S Life Cycle  
M&S Life Cycle  
M&S Life Cycle  
Technical Engineeri

M&S Life Cycle  
M&S Life Cycle  
M&S Life Cycle  
(Cost)

Partnership  
Partnership  
Partnership  
Partnership  
(JOINT)

Education  
Education  
Education  
Education  
Education  
(CGSC)

April 2005 Seattle, WA  
(Tentative)

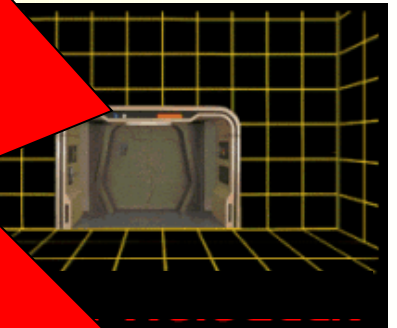
Parting  
Shot

# Virtual Prototyping

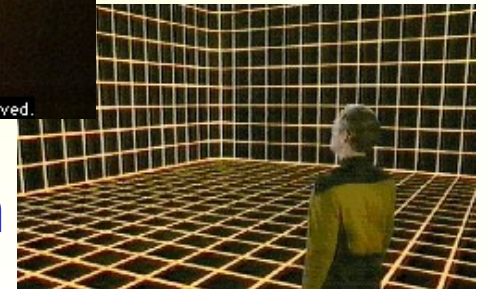
Bringing



We've got to  
Make This a Reality,  
**NOT JUST A VISION**  
**Thus VV&A of M&S**  
**IS ESSENTIAL!!!**



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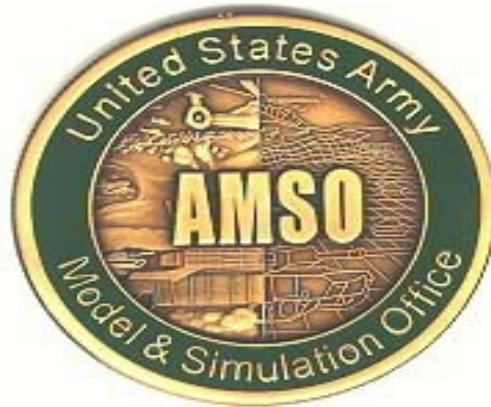


Serious Play is not an Oxymoron  
It Is The Essence of Innovation

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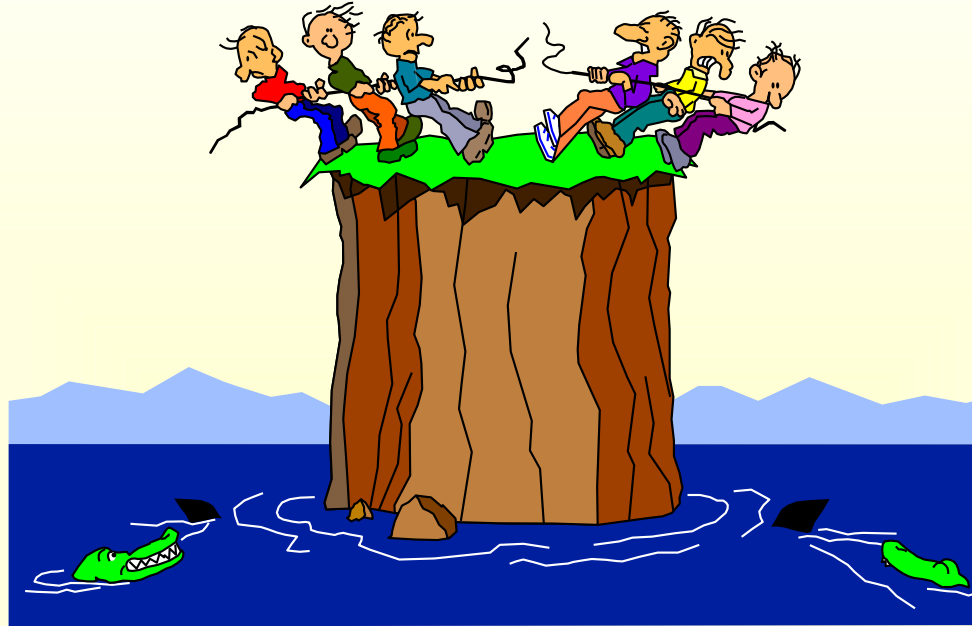


329-0012



Disparity  
Island

# Don't put yourselves on Disparity Island



**Oh boy, dinner!**

Yeah, somebody didn't verify some units,  
another didn't val...

**Who cares?**

Yeah, we get to bite their dust

'cause in VV&A they didn't spend the bucks.